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REVIEW ARTICLE (META-ANALYSES)

Is Extracorporeal Shock Wave Therapy Clinical Efficacy for Relief of Chronic, Recalcitrant Plantar Fasciitis? A Systematic Review and Meta-Analysis of Randomized Placebo or Active-Treatment Controlled Trials

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Abstract

Objective: To assess the efficacy of extracorporeal shockwave therapy (ESWT) and provide clinicians with an evidence base for their clinical decision making.

Data Sources: PubMed, MEDLINE, Embase, Cochrane Central Register of Controlled Trials, and Evidence-Based Medicine Reviews.

Study Selection: All randomized or quasi-randomized controlled trials of ESWT for chronic recalcitrant plantar fasciitis were searched. Searching identified 108 potentially relevant articles; of these, 7 studies with 550 participants met inclusion criteria.

Data Extraction: Number of patients, population, body mass index, duration of symptoms, adverse effects, blinding method, and details of shockwave therapy were extracted.

Data Synthesis: For intervention success rate, ESWT of low intensity was more effective than control treatment of low intensity. For pain relief, the pooled data showed a significant difference between the ESWT and control groups. For function, only low-intensity ESWT was significantly superior over the control treatment.

Conclusions: The efficacy of low-intensity ESWT is worthy of recognition. The short-term pain relief and functional outcomes of this treatment are satisfactory. However, owing to the lack of a long-term follow-up, its long-term efficacy remains unknown.

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Heel pain, occurring in >11% to 15% of adults, is the most prevalent complaint of patients who present to foot and ankle specialists.[1,2] Plantar fasciitis is the most common cause of inferior heel pain in adults,[3,4] which requires professional care. Heel pain has been called by various names, including heel spur syndrome, which lends some importance to the radiographic presence of an inferior calcaneal spur in addition to clinical symptoms. The term plantar fasciitis has also been used for many years in the published literature. It is estimated that >1 million patients seek treatment annually for this condition, two thirds of whom visit their family physician.[5] The etiology of plantar fasciitis is poorly understood and likely multifactorial.[6] This condition is thought to be caused by biomechanical overstress of the calcaneal tuberosity.[7-11] Discussion of its biomechanical etiology usually involves the windlass mechanism and tension of the plantar fascia in both stance and gait.[12] Mechanical overload, irrespective of whether it is the result of biomechanical faults, obesity, or work habits of prolonged standing and running, may contribute to the symptoms.[13,14] Numerous studies have reported this condition to be plantar fasciitis, implying that its etiology is more likely a chronic degenerative process than acute inflammation.[15]

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The diagnosis of plantar fasciitis is based on the patient's history and results of physical examination.[16] Patients usually present with plantar heel pain on initiation of weight bearing, particularly in the morning on arising and after periods of rest. The pain tends to decrease after a few minutes and returns as the day proceeds and the amount of time the patient spends on their feet increases; this pain usually persists for months or years. Another important characteristic is the location of the pain, usually occurring at the origin of the plantar fascia from the medial tubercle of the calcaneus.[17]

Diagnostic imaging is rarely needed for the initial diagnosis of plantar fasciitis because it may not be helpful; although, it should be considered to rule out other causes of heel pain or to establish the diagnosis of plantar fasciitis when doubts arise. Plain radiographs often reveal a heel spur on the inferior surface of the calcaneus. The presence or absence of heel spurs is not useful in diagnosing plantar fasciitis. Heel spurs are common in asymptomatic individuals and may be an incidental finding. The percentage of asymptomatic individuals in whom heel spurs are present on routine radiographs is about 20%.[18] The results of several studies comparing patients with and without plantar fasciitis showed that patients with thicker heel aponeurosis are associated with plantar fasciitis identified by ultrasonography.[19,20] Bone scans can distinguish between plantar fasciitis and calcaneal stress fracture, and magnetic resonance imaging can show thickening of the plantar fascia.[21] However, these modalities are not routinely used.

Associated significant findings indicate that the risk factors for plantar fasciitis include excessive foot pronation and running, high arch, obesity, high body mass index, tightness of the Achilles' tendon and intrinsic foot muscles, and inappropriate footwear.[17,22-26]

Conservative treatments help alleviate the disabling pain, consisting of rest, shoe inserts, activity modification, oral analgesics, night splints, stretching, and corticosteroid injections.[16,19] If a patient's heel pain lasts $\geq$6 months, it is considered chronic recalcitrant plantar fasciitis.[27] If at least 6 months of conservative treatment is ineffective, extracorporeal shockwave therapy (ESWT) and surgery can be considered.[27] Surgical options for the management of plantar fasciitis resistant to conservative management include endoscopic and open fasciotomy. Operative treatment has shown promising results, but it is associated with morbidities, such as injury of the posterior tibial nerve and its branches, including the medial calcaneal nerve,[2] tarsal instability, swelling of the incision site, immobilization, and potential complications (eg, arch flattening, nerve injury, calcaneal fracture, long recovery time).[28,29]

ESWT has been used for the treatment of recalcitrant heel pain syndrome as an alternative to surgery for decades.[30-34] It is widely used because it enables fast recovery without the necessity of reduced weight bearing or immobilization. The rationale for the use of ESWT for these conditions is based on stimulation of soft tissue healing by local hyperemia, neovascularization, reduction of calcification, inhibition of pain receptors, and denervation to achieve pain relief and persistent healing of chronic processes.[35] A consensus regarding the optimal ESWT intensity is lacking.

Considerable controversy has emerged regarding the use of ESWT for plantar heel pain.[36-40] For chronic recalcitrant plantar fasciitis, only 1 review by Dizon et al[41] has discussed the efficacy of ESWT. However, the study has some limitations (eg, lack of uniformity in certain outcome measures). Therefore, further research is necessary to evaluate this issue.

In general, we found that there were no high-quality studies that had investigated the efficacy of ESWT for chronic recalcitrant plantar fasciitis using comprehensive items, and the existing studies provide no conclusive evidence to support the effectiveness and intensity of ESWT for treating the disease.

The purpose of this meta-analysis was to assess the efficacy of ESWT and provide clinicians with an evidence base for their clinical decision making. Furthermore, the adverse effects that may occur during the use of ESWT were evaluated.

List of abbreviations:

CI	**confidence interval**
ESWT	**extracorporeal shockwave therapy**
MD	**mean difference**
RCT	**randomized controlled trial**
RM	**Roles and Maudsley**
RR	**risk ratio**
VAS	**visual analog scale**

Methods

Search strategy

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) recommendations for this meta-analysis.[42] With the assistance of a medical research librarian, we performed serial literature searches for English and non-English articles. The following electronic databases were searched from their inception dates to April 2013: PubMed, MEDLINE, Embase, Cochrane Central Register of Controlled Trials, and Evidence-Based Medicine Reviews. We used Boolean logic with search terms including plantar fasciitis and shockwave therapy. Appendix 1 provides a more detailed account of the search strategy. Because all of the various databases used for this study possessed their own subject headings, each database was searched independently. All human studies that were published in full abstract and text forms were eligible for inclusion, with no restrictions on publication date, language, and status. To reduce the effect of publication bias, conference posters and abstracts were electronically searched through the Conference Papers Index provided by ProQuest, BIOSIS, and SCOPUS. Ongoing clinical trials were identified from the ClinicalTrials.gov website. The references for all located articles, including other systematic reviews, were searched manually for additional relevant articles. We attempted to contact the corresponding authors of the design articles via e-mail to ask if any new results were available.

Inclusion criteria

Types of studies

We included all randomized or quasi-randomized controlled trials of ESWT for chronic recalcitrant plantar fasciitis as defined by the trial investigators, identified by various clinical descriptors. We excluded abstracts and studies for which outcome measures for heel pain could not be separated from the data. For the purpose of our review, studies that lacked reporting of successful treatment standards were also excluded (eg, only stating a decrease of visual analog scale [VAS] scores). In addition, trials that compared different types of shockwave therapy (eg, radio shockwave therapy, focus shockwave therapy) were excluded.